What kind of knowledge is needed about toxicant-related health issues? Some lessons drawn from the Seveso dioxin case

Laura Centemeri

Chapter 6

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<FL> Dioxins, a class of chemical contaminants produced in both natural and industrial processes, were discovered in the late 1950s and have been extensively studied since the early 1970s. The majority of studies have focused on the most toxic congener, 2,3,7,8-TCDD, simply called dioxin,[1] with much toxicology, biochemistry, and epidemiology research having been aimed at determining its effects on humans, in particular its carcinogenic effects. Nevertheless, despite thirty years of intensive research, exactly how dangerous dioxin is remains a controversial issue. In 1997 the International Agency for Research on Cancer (IARC) classified TCDD as a group 1 carcinogen based on limited evidence on humans, sufficient evidence on animals, and extensive mechanistic information. This classification has stirred controversy, in particular concerning the use of mechanistic data to interpret cancer risk in humans (Cole et al. 2003; Steenland et al. 2004). In 2009, IARC confirmed the inclusion of TCDD in group 1, citing sufficient epidemiological evidence for all cancers combined (Baan et al. 2009).

All the direct evidence on acute dioxin effects on human health comes from epidemiological studies of human populations exposed accidentally or occupationally to elevated dioxin levels. One of the cases most studied in the dioxin carcinogenicity literature concerns the population living in the area of Seveso, Italy. In 1976 an industrial accident in the chemical factory ICMESA (owned by the Swiss multinational corporation Roche) exposed the residents of the surrounding area—in particular the inhabitants of Seveso, Meda, Cesano Maderno, and

Desio—to the highest exposure to TCDD known to have occurred in humans (Eskenazi et al. 2001). To quote an epidemiologist involved in the follow-up studies investigating the health consequences for the population affected: "The accident was a tragedy, for sure, but for us scientists, I must admit, it has been a rare chance to have a sort of laboratory situation, so to explore how dioxin works on human beings."[2] This chapter focuses on the paradox of this "laboratory population" that is playing such a crucial role in the controversy concerning dioxin carcinogenicity.

The paradox is as follows: the vast scientific output concerning dioxin effects in Seveso is having no impact in terms of public health measures implemented in the area affected, in particular as far as prevention is concerned. This scientific output is oriented exclusively around the problems and discussions that have emerged over the uncertainties surrounding dioxin toxicity and the problem of its regulation.

At the same time, the population affected has not engaged in collective action to seek full disclosure of the impact of dioxin contamination or of epidemiological studies concerned with local environmental health and prevention. In the ICMESA disaster area, environmental health—and most specifically long-term dioxin health effects—are not questions of public concern and mobilization, but they are rather the source mostly of "rumors" circulating in the community, or of the personal troubles of those directly touched by diseases that might be linked to dioxin exposure. Using a dichotomy introduced by Charles Wright Mills (1959), dioxin in Seveso is not a public "issue" but a matter of personal "troubles."[3]

In this paper, I discuss how this double framing of dioxin's long-term health effects—either as a pure scientific problem or as purely personal troubles—has emerged. The hypothesis I advance is that this double framing has affected the kind of scientific knowledge produced on

local effects of dioxin contamination. Moreover, the Seveso case shows how the global regulation of toxicants relies on a very specific kind of knowledge, focused on the issue of carcinogenicity and employing a mono-causal explicative model of the onset of cancers. There is a gap between this kind of knowledge output meant for regulation and the knowledge relevant for the implementation of local prevention policies to assure environmental health.

In order to develop this argument, I will first analyze the responses to the Seveso disaster, in particular the choices made by the public authorities (at the regional and national levels) to manage the crisis. The role of the public authorities in responding to the dioxin contamination emerges as crucial when trying to give an account of the specific way in which dioxin was interpreted as a collective threat by the population affected. I will then focus on the local pressure groups and the conflicting interpretations of dioxin risk they supported. Through investigating the dynamics of these organizations and their interplay with the public authorities' crisis management approach, I show how the dioxin risk was never framed as a problem of public health in the area affected. I also show how an interpretation of dioxin as a cultural threat came to prevail among the population exposed to the contamination. This prevailing interpretation of dioxin seems to have acted as an obstacle against any popular movement toward asking the public authorities to respond to environmental health problems in the contaminated area. These problems are related not only to the dioxin contamination but also more generally to the chronic chemical pollution caused by chemical factories located in the area since the 1950s.

In the final section, I discuss the lessons from the Seveso case about the construction of environmental risks as public problems, and in particular the role played by participation, which is to be understood here as meaning dialogue among scientists, citizens, activists, and public authorities. This dialogue seems to be necessary to prompt scientific research to address health

issues not in terms of individual problems but as part of the condition of local populations. This dialogue is also necessary to ensure that issues of uncertainty, which are ubiquitous in the study of toxicants, are not dealt with only within restricted circles of scientists but in public arenas in which priorities—for research and action—can be defined in a more democratic way, that is, in a more inclusive plural way. When this dialogue fails, research on environmental health issues becomes more easily detachable from its geographical dimension, and tends to focus exclusively on a laboratory approach that only partially responds to public health concerns. Moreover, this approach obscures under a veil of objectivity the political dimensions of making regulatory choices in situations involving uncertain scientific knowledge.

<HDA> **Seveso: The Disaster and the Response of the Public Authorities**

<FL> It is always difficult to give a concise description of a disaster and its consequences when addressing the problem from a sociological point of view. The official "toll of the tragedy" is often the object of endless controversy and, moreover, it tells nothing of the long-term impact of an event on the community affected. A variety of sociopolitical processes, including framing processes, shape disasters, making them generative of social change. These processes take place at different times and in different, but intertwined, public arenas: local and global political arenas, and expert arenas, in particular legal and scientific ones (Jasanoff 1994).

The main feature of the Seveso disaster is that it was the first major accident in the chemical industry at the European level. It contributed to the definition of the European directive (Directive 82/501/EEC, the "Seveso Directive") on the major-accident hazards of certain industrial activities (De Marchi, Funtowicz, and Ravetz 1996; De Marchi 1997; De Marchi, Funtowicz, and Guimares Pereira 2001). Another important feature is that "there were no

fatalities following the accident," as Stavros Dimas, European Commissioner for the Environment, stated when commemorating its thirtieth anniversary in 2006.[4] In fact, at the European level, the Seveso disaster is considered an "information disaster" (van Eijndhoven 1994). It helped to highlight the fact that a lack of information about hazardous industrial processes is a major source of vulnerability in our highly industrialized societies.

To quote Dimas again: "The reason for this particular accident becoming such a symbol is because it exposed the serious flaws in the response to industrial accidents." The absence of "fatalities," connected to the recovery of the contaminated area (Ramondetta and Repossi 1998), also explains why eco-skeptic books often cite the case of Seveso as an example of "unjustified alarmism" (Kohler 2002).

This emphasis on the event itself and its consequences has completely concealed the reality of a community exposed to chemical pollution since 1945. This reality has never been seriously investigated in terms of its human and environmental costs. The harmfulness of ICMESA, even though known to the local community, became a public concern only with the accident of July 1976 and merely in terms of the specific consequences of dioxin contamination. Moreover, although there has not been the health catastrophe expected by some back in 1976, dioxin contamination has affected people's health with various degrees of gravity. A 25-year follow-up study of mortality in the population exposed shows excesses of lymphatic and hematopoietic tissue neoplasms, diabetes mellitus, and chronic obstructive pulmonary disease (Consonni et al. 2008). A more recent study examining the relation of serum TCDD with cancer incidence in 981 women from the most contaminated areas—and part of the wider project Seveso Women's Health Study run by researchers of the School of Public Health, University of California, Berkeley—shows a significantly positive all-cancer incidence in this cohort, thirty

years after the accident (Werner et al. 2011).

In spite of the disaster, its direct effects, and the reality of previous chronic pollution that it brought to light, the issue of environmental health has never been a cause for public concern or activism in the communities affected, thus contributing to the absence of this issue in local public debate. At the same time, the Seveso case has been extensively studied by epidemiologists within the frame of research on the toxic effects of dioxin on human beings. This scientific output has had no impact on the area directly concerned, either in terms of local public health policies or victims' mobilization. How can this paradox be explained?

In order to develop our analysis, we first need to introduce some context. Seveso is a town of twenty thousand inhabitants, located 15 km north of Milan, the regional capital of Lombardy, in the geographical area known as *Brianza Milanese*. *Brianza* is a "district area" (Bagnasco 1977) with a strong Catholic cultural tradition, specializing in furniture production and design by small, family-owned firms. After World War II, chemical companies began to install plants in the area because of the rich water resources and the good transport infrastructure. Thus, two different models of production organization and integration came to coexist in the area. The accident at the origin of the Seveso disaster occurred in the ICMESA chemical plant (located at Meda, near Seveso), which had 170 workers and had been owned since 1963 by the Swiss multinational corporation Roche through its subsidiary Givaudan. It produced intermediate compounds for the cosmetics and pharmaceutical industry among which, since 1969 and more intensively in the 1970s, was 2,4,5-trichlorophenol (TCP), an inflammable toxic compound used for the chemical synthesis of herbicides.[5]

On Saturday, 10 July 1976 at around 12:30 A.M., the reactor where trichlorophenol was produced released a toxic cloud of dioxin and other pollutants because of a sudden exothermic

reaction caused by the breakdown of a safety valve.[6] The hazardous gas produced by the twenty-minute emission settled on a large area of about 1,810 hectares in the municipalities of Seveso, Meda, Desio, Cesano Maderno, and, although to a less serious extent, seven other municipalities in the province of Milan.

The 2,3,7,8-tetrachloro-dibenzo-para-dioxin (TCDD), simply called dioxin that was released by the ICMESA reactor[7] is an extremely dangerous molecule due to its very high toxicity, persistence, and stability. Nevertheless, dioxin was little known at the time of the accident.

In 1976, knowledge of the extremely harmful effects of dioxin on human health was mostly based on suppositions resulting from toxicological evidence. There had been few epidemiological studies and they had been limited to following up on cohorts of industrial workers. Dioxin environmental contamination affecting an entire population was without precedent. Scientists were unable to anticipate the damage to be expected (to the environment, animals, or human beings of varying sex and age) and neither were they able to provide decontamination methods. Besides, there were no technical instruments to measure human blood dioxin levels (Mocarelli 2001). The result was a "radical uncertainty" (Callon, Lascoumes, and Barthe 2001) surrounding the consequences of the contamination to be expected for human health and the environment, and their extent in both space and time. There was just one certainty: the extreme toxicity of dioxin proven in laboratory tests. This led to fears of catastrophic scenarios.

These catastrophic scenarios, however, did not materialize immediately after the accident. The toxic cloud passed largely unnoticed, with the Seveso and Meda people considering it just a "usual" nuisance, one in a long series. A "week of silence" (Fratter 2006) passed, but in the

meantime various alarming phenomena were noticed in the area near ICMESA: a sudden fall of leaves; the deaths of small animals (birds and cats); and a "mysterious" skin disease (chloracne) affecting children. Anxiety grew among the population. On 19 July, Roche experts informed the Italian public authorities that the accident at the ICMESA plant had caused widespread dioxin contamination and highly recommended the evacuation of part of Seveso's and Meda's populations as a precautionary measure.

On 24 July the evacuation began: 736 inhabitants of Seveso and Meda were forced to leave their houses with all their personal belongings inside. Two hundred people never returned to their houses, which were demolished during the decontamination. "Risk zones"[8] were created, officially on the basis of the estimated trajectory of the toxic cloud and of random dioxin concentration tests on the ground. In fact, the criteria adopted to delimit risk zones also included practical feasibility and the reduction of the negative social side effects that were to be expected in the case of massive displacements.

The design of the risk zones implied a delimitation of the area officially considered "at risk." Faced with widespread contamination probably affecting a large and difficult-to-define area, the public authorities tried to reduce the "risk" area to the minimum. This reduction of the crisis area had the effect of producing an overlap between the district of Seveso—and its population—and the area at risk. Of the municipalities affected, it was Seveso that became the only one constantly associated with the crisis, particularly in the media. The association of the name Seveso with dioxin was considered a form of injustice by its citizens. It appeared to them that the regional and national authorities had decided to sacrifice them in order to reduce the extent of the crisis.

This clear-cut definition of the area at risk was just one of the measures adopted to reduce

the uncertainty that the public authorities were confronted with. In fact, the authorities further decided to reduce uncertainty by denying it, by acting "as if" there were none. Another measure was the creation of Technical-Scientific Committees of experts in charge of deciding on the steps to be taken to manage the dioxin health risk, decontamination, and the socioeconomic implications of the crisis. The definition of the problems at stake was delegated entirely to the experts. These committees were in fact taking decisions of a political nature and were therefore not just advisory committees (Centemeri 2006: 87–96).

With the public authorities embracing a "paternalistic stance" (Conti 1977), the citizens—and their political representatives at the municipal level—were not allowed to participate in decision making. Nevertheless, decisions were made that greatly affected them, as persons and as a community. In particular, given the suspected teratogenic effects of dioxin, pregnant women from the contaminated area (within the third month of pregnancy) were "left free" to ask for a medical abortion. Abortion was still illegal in Italy, and in fact the Italian social movements' fight for its depenalization was at its peak.[9] About thirty women from the contaminated area—although the precise number is not known—decided to interrupt their pregnancies (Ferrara 1977).

<HDA> **From Scientific Controversy to Cultural Conflict: Rival Local Interpretations of the Dioxin Crisis**

<FL> Given the radical uncertainty surrounding the effects of dioxin, it was clear to the citizens that public decisions could not rely on any kind of scientific "truth." In fact, the scientific controversies over dioxin risk were widely discussed in the media.

The scientific uncertainty surrounding the effects of dioxin implied that the decisions taken in response to the crisis were not just technical, but political. Nevertheless, the public

authorities insisted on denying uncertainty. No public debate involving the communities affected took place to define the problems to address in response to the contamination or how to address them. Nevertheless, conflicting definitions of the problems involved in responding to the crisis emerged. This happened through the mobilization of the people affected and of national social movements, resulting in contentious public controversies.

In particular, one controversy was centered on the question of whether potential malformation of embryos caused by dioxin should be prevented through abortion. In fact, abortion rapidly became the central issue in the national public debate concerning the dioxin effects in Seveso. In this debate, the Catholic Church, whose influence was very strong locally, opposed left-wing movements. Other controversies concerning the uncertainty of long-term dioxin health effects slipped into the background. The centrality gained by the abortion controversy largely explains the shift of the dioxin risk from being a public health problem to a moral-cultural problem.

Another controversy contributing to this same shift was related to the issue of what should be considered "safe." The public authorities defined safety by starting from the detached standpoint of experts and laboratory science. In this view, safety is the condition of not being exposed to risk and so displacement from the contaminated area was considered the solution guaranteeing the highest level of safety. Local committees of Seveso citizens supported a different definition of safety. They argued for the relevance of a specific risk: that of the Seveso community disappearing as a result of the way the public authorities were responding to the contamination. This response sought to preserve not only individual safety but also the "attachment to the territory" that was shared by the population affected in terms of being a community. This *attaccamento al territorio* (attachment to the territory) refers to the feelings of

familiarity with people and spaces held both individually and collectively by the inhabitants. This familiarity is acquired over time, through the everyday experience of living together in a specific place, and is transmitted from one generation to the next.

Attachment to the territory also refers to the fact that place is considered a constituent of the collective and individual identity, at the same time bearing the traces of a specific way of organizing individual and collective life. It thus refers to both active participation by the territory in shaping social life and at the same time the shaping of the territory by the activities of the community inhabiting it (Berque 2000; Breviglieri 2002; Thévenot 2006).

Arguing for the relevance of attachment to the territory as a public good to be preserved while responding to the dioxin crisis, the local Seveso committees found themselves opposing not only the public authorities but also the national social movements mobilized in Seveso to support the victims.

Social movements already active in the Italian political scene on the issue of environmental health, together with left-wing political parties, mobilized in Seveso. They organized a Scientific Technical Popular Committee (STPC) to help those they considered "victims" obtain justice for their suffering. One of the most important actors in this movement was Medicina Democratica (MD).[10] For MD, the Seveso disaster required a large coalition of citizens and workers to impose the issue of environmental health on the political agenda. The concept of environmental health involved health damage caused by industrial production both inside and outside plants. Underlying this, there was a discourse of social criticism of capitalist exploitation (Boltanski and Chiapello 1999). Capitalist exploitation entailed "hidden costs"—"hidden" because of the control exerted over scientific knowledge production by hegemonic forces. MD's struggle was oriented toward democratizing the production of knowledge to make

those responsible for the negative consequences of industrial society socially accountable.

The call for widespread mobilization of the people affected by the contamination and their participation in the production of knowledge about dioxin damage found little response from Seveso's population, thus reducing the critical force of MD's public arguments.

This lack of support from the affected people can be explained if we consider that MD interpreted the dioxin contamination in Seveso and its effects in terms of criticizing capitalism. The Seveso disaster was considered a typical "capitalist crime" (Maccacaro 1976). What was happening in Seveso was a clear example of capitalist injustice, which needed to be denounced. The Seveso people were being asked to join the preexistent cause of the workers and their class struggle. There was no place for more local or even personal definitions of the issues at stake in the disaster situation. In this respect, the activists were as incapable as the public authorities of understanding what mattered to the Seveso people in responding to the dioxin crisis.

For a large majority of these people, the priority in responding to the crisis was to maintain their previous way of life, to preserve the specificity of the relationship between their community and their territory—but neither the public authorities nor the left-wing activists were able to take this dimension of attachment to the territory into account.

The scientific uncertainty about dioxin risk implied that no clear evidence was available to support the public authorities' and social movements' interpretation of the dioxin risk. Appealing to this uncertainty, a grassroots mobilization of strong Catholic background took shape and urged the public authorities to consider not only the seriousness of the health risk but also the fear that Seveso as a community might disappear. The collective damage caused by dioxin was thus interpreted as damage to the community. However, the public authorities opened no arenas for public discussion of these issues, and neither did they propose any mediation. This caused the

grassroots movement to radicalize its protest. This radical turn became visible in the central role assumed within it by the militants of the Catholic movement Comunione e Liberazione (CL). For CL, the disaster was not a "crime," but a "test" of the community's ability to stick together, and to its values, in responding to the crisis. CL asked the public authorities to recognize a right of the local community to self-organization in its response.[11]

This interpretation of the dioxin damage as a cultural threat to the community and its values contributed to obscure the controversial implications of the contamination: those jeopardizing community cohesion and in particular the long-term health effects. Moreover, the way the Swiss multinational corporation Roche managed compensation to the victims in the immediate aftermath of the disaster also contributed to downgrading the public health consequences to the level of personal problems. The compensation issue was dealt with through instruments of private settlement in the form of individual contracts agreed on between victims having suffered material losses and the multinational corporation. No public discussion took place on how to compensate for the negative consequences of the disaster that were to be expected in the future.[12]

<HDA> **Long-Term Dioxin Health Effects in Seveso: A Scientific Problem, an Invisible Public Health Issue**

<FL> The interpretation of dioxin as a threat to the community instead of a public health problem led to a situation in which scientists alone were left in charge of exploring and assessing the health consequences of the contamination.

The design of the research on dioxin health effects was heavily influenced by laboratory science and by the controversies surrounding the carcinogenic effects of dioxin. There was no

involvement of the population affected in terms of participation in the production of knowledge. Furthermore, the people affected never asked to be directly involved in the design of this scientific research.

As Wynne (1996: 52) remarks, an absence of criticism of expert knowledge does not automatically equal trust. The relationship between lay people and experts is in fact ambivalent: dependency and lack of agency might both explain lack of voice. In the case of Seveso, the dioxin damage was interpreted by the population affected as a cultural threat affecting a community. This is an important dimension that should be taken into account to understand why dioxin never became a public health issue in the area affected. At the same time, the case of Seveso tells us much about the specific kind of knowledge that is assumed to be relevant in the debate over toxicants and carcinogenesis, and is consequently funded and supported by research institutions and public agencies that are looking for solid evidence to guide regulation.

Today, research on dioxin effects has partially assessed the damage from the contamination in Seveso, revealing that it is not limited to cancers but also includes transgenerational effects, in particular, thyroid dysfunction linked to maternal exposure (Baccarelli et al. 2008). Nevertheless, the scientific controversies remain acute because the Seveso data are insufficient to establish clear-cut cause-effect relations.

For science, dioxin is still an incomplete jigsaw puzzle because of the complexity of the mechanisms of its interaction with the human body. As Douglas (2004) notes, dioxin challenges current models for assessing the carcinogenicity of toxicants and shows how regulating toxicants, relying on carcinogenic effects, cannot be just a matter of uncontroversial scientific evidence. This uncontroversial scientific evidence is a chimera and conceals decisions made by scientists (in terms of research priorities, or of data excluded as irrelevant) in order to reduce uncertainty

(Latour 1987). Uncertainties about toxicant carcinogenicity abound, and they are related to the complexity of the interactions involved when investigating carcinogenesis. Nevertheless, the dominant paradigm, which explains carcinogenesis on the basis of one single factor accounting for its insurgence, is still the reference point for defining what knowledge should count for regulation.

Despite being widely mentioned in the literature concerned with dioxin carcinogenicity, the Seveso population shows no interest at all in knowing more about how this knowledge is produced and what it means in terms of the consequences for public health. It sees scientists as "people who made their careers exploiting our misfortune and using us as guinea-pigs."[13] To quote Massimo Donati, a family physician in Seveso who personally spent ten years trying to organize dioxin victims to start a legal action against Roche:

> <EXT> You cannot speak about all the scientific results concerning dioxin effects here in Seveso. It is a taboo: public administrators and citizens don't want to speak about it. I'm in contact with Seveso people on an everyday basis, because of my activity as a physician, and I can tell you that people are divided in two categories. You have people, the large majority, who don't care about dioxin, because they are fine or because they were not exposed. Then you have people who were exposed to the dioxin contamination and who are now sick: immediately they ask if dioxin could be a possible cause of their disease. It would be necessary to organize an epidemiological study in parallel to those already in place with the data collected by family physicians, with a geographical representation of the distribution of pathologies. This is necessary to see if there are localized concentrations of pathologies.[14]

What Donati complains about is the fact that the scientific output on the dioxin effects in

Seveso focuses exclusively on issues and questions defined within the generalized detached frame of understanding how dioxin (in general) interacts with the human body (in general). This is the kind of research promoted and funded by public and private actors, "because then you can publish your article in a scientific journal. But I need knowledge on dioxin effects that allows me to act for public health in this area, and this kind of knowledge is lacking."[15]

There is no link between the scientific work on dioxin effects based on the Seveso case and the territory of Seveso. First of all, no epidemiological research has been done starting from health concerns defined as such within the area, such as for example the perceived presence of possible anomalies in the concentrations of pathologies reported by isolated actors (physicians, ordinary citizens). Second, there is no link between the epidemiological studies on dioxin in Seveso and the implementation of preventive action in terms of public health in the area affected by the disaster. Donati's idea of starting an epidemiological study using the geographical area as the central reference point (rather than the individuals exposed according to risk zones) has not found support, either from the regional authorities or from the population.

In fact, the epidemiological studies on the effects of the dioxin contamination in Seveso are mainly focused on using the Seveso case to explore the biochemical mechanisms through which dioxin can affect human health. It is not by chance that these studies have focused progressively on the populations of the three risk zones. This population is in fact of particular scientific interest because it was exposed to high concentrations of pure dioxin with no other relevant forms of exposure to toxic sources. Data concerning the ICMESA workers and the workers employed in the decontamination activity were only collected until 1985. In this case, other kinds of exposure might severely interfere with the dioxin exposure, making this cohort scientifically less interesting. This fact reveals the specific logic that underlies the

epidemiological research on dioxin exposure in Seveso: to identify the specific way in which dioxin interacts with the human body by trying to "purify" this effect from possible interferences related to situations of multiexposure. We can define this logic as a laboratory logic. It is detached from the territory and it is focused on the interaction of the toxicant with a partially decontextualized human being. It is considered fundamental to defining the forms of regulation that should be applied across different contexts.

The aim here is not to say that a "health disaster" went unnoticed in Seveso because of the incapacity of the laboratory logic dominant in epidemiological studies to detect it, but rather to highlight how the knowledge produced on the dioxin effects in Seveso is based on a very specific model of the production of epidemiological data. The issue to be discussed is the consequences of this lack of pluralism in the epidemiological investigation into dioxin effects in Seveso.

In fact, a problem of environmental health such as the dioxin contamination caused by ICMESA can be explored by starting with at least four different and complementary epidemiological approaches: a molecular approach, an individual approach, an approach in terms of population, and an approach in terms of ecosystem (Pekkanen and Pearce 2001). In the case of Seveso, the epidemiological studies were first driven by an individual approach, studying the individuals living in the risk zones. They then evolved toward investigations exploring the molecular mechanisms involved in dioxin toxicity. As previously stressed, there has been no epidemiological study defined in terms of studying the present state of the area affected by the disaster, looking at the pathologies observed, rather than exclusively following the individuals living in the risk zones defined in 1976.[16] The problem involved in relying exclusively on epidemiological studies interested in exploring environmental risks at the individual and molecular levels is that of disconnecting epidemiological studies from a public health goal, from

the production of knowledge useful for prevention on the territory in a locality (Pekkanen and Pearce 2001). The rules prevailing in the scientific community thus create a space for debate that is autonomous in a way, that is, it is guided by hypotheses, methods, and investigation procedures defined as such within a specific paradigm of knowledge in which the individual (with her genes, her behaviors) is considered the reference point.[17]

The Seveso case shows how the prevailing model in the debate concerning the effects of toxicants on human health and regulating them is that of looking for a direct cause-effect relationship in terms of carcinogenicity, assuming the individual as the reference. In doing this, by limiting itself to the pursuit of knowledge relevant to global regulation and legal norms for compensation (both dominated by the logic of univocal cause-effect), epidemiology seems to abdicate the role of also providing knowledge relevant to acting to guarantee public health in the areas at risk.[18]

<HDA> **Final Remarks**

<FL> The dioxin contamination caused by the ICMESA accident has never emerged in the area affected as an issue of environmental health. This can explain the specific direction taken by the epidemiological research on long-term dioxin effects in Seveso, which was mainly guided by a laboratory logic (focused on carcinogenesis) but not connected with a prevention logic. Although this laboratory logic may be crucial for setting regulation standards, as the Seveso case shows, ongoing controversies can lead research to be monopolized by the internal logic of these issues and to reduce to marginality, to the point of complete obscurity, any perspective oriented toward the production of knowledge of use in implementing actions beneficial to local environmental and public health.

The absence of involvement by the citizens affected in the production of knowledge about dioxin effects is crucial for explaining how research on the dioxin effects in the Seveso area developed and progressively detached itself from the territory.

We have tried to explain this lack of citizen involvement by linking it to the interpretation given to dioxin risk by the grassroots groups mobilized following the ICMESA disaster. In particular, dioxin was seen as a threat to the very existence of the community. The fact that the public authorities opted for an authoritarian approach to managing the crisis increased this fear. At the same time, the movement for environmental health active in Italy in the 1970s took a highly ideological approach to the disaster situation. This created difficulty in integrating into its agenda the point of view of the victims and their fears concerning the disappearance of Seveso as a community. The centrality acquired by the issue of therapeutic abortions highlights the conflicting values that became an obstacle to the dialogue between the population affected and the activists. Moreover, we should not overlook the contribution by Roche to the individualization of the dioxin damage in reducing its attention to the dimension of material losses.

No "uneasy alchemy" (Allen 2003) among citizens, activists, public authorities, and scientists took place in the aftermath of the disaster, thus causing the issue of dioxin as a problem of public health to become progressively invisible in the public space.[19] Dialogue among these groups seems in fact to be a necessary condition for the production of knowledge about environmental health problems that can help the design and implementation of prevention policies at a local level.

The dioxin disaster was a moment of high visibility of the hidden costs of industrial production in terms of environmental and human health. Nevertheless, in the area affected,

environmental health never became an issue. The Seveso disaster turned out to be, paradoxically, an event that contributed to the invisibility of the issue of environmental health in the heavily industrialized *Brianza Milanese* area. This should make us aware of the difficulties that are always present in the construction of environmental health issues as public problems.

A lesson we can learn from the Seveso case is the central role of public participation in decisions concerning how to respond to environmental risks arising from toxicants. When public authorities rely exclusively on experts to define what a risk is, and what the priorities should be in responding to it, they fail in their role to aid the collective construction of the specific risk as a public problem. They fail to take into account the existence of the different concerns the risk raises at the local level and the different kinds of knowledge that should be considered legitimate in shaping the orientation of research. An absence of participation results in turning the risk into an external object that communities are not able to appropriate and turn into an actual concern. This risk "externalization," in turn, heavily affects the kind of knowledge produced about the risk itself, promoting a vicious circle of separation between knowledge for global regulation and that relevant to local situations.

Joint involvement of citizens, activists, scientists, and public authorities is necessary in order to promote the production of knowledge about environmental risks related to toxicants that is not exclusively guided by laboratory logics but that seriously takes into account the local dimension of environmental health. In this process, the role of public authorities of guaranteeing the conditions for participation is crucial. Power inequalities have a key effect on the process of making things visible. These inequalities have to be addressed in order to create the conditions for collectively dealing with the harmful consequences of industrial activities.

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<HDA> **Notes**

1. The compound 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) is produced as an unwanted by-product in various chemical reactions and combustion processes, including the manufacture of chlorinated phenols and derivatives.

2. Milena Sant, speaking about her experience in Seveso at the public event organized by the feminist group Maistat@zitt@, "Topo Seveso. Produzioni di morte, nocività e difesa ipocrita

della vita." 14 April 2007, Milan.

3. The analysis I develop in this contribution is based on my Ph.D. research on the collective responses to the Seveso disaster (Centemeri 2006). The research was designed to investigate the legacy of the ICMESA accident in the community affected through historical analysis of the 1976 event and an ethnographic study concerning the ongoing construction of a collective memory of the disaster, namely, the project "Bridge of Memory" run by a group of local activists. The data discussed here were collected through the analysis of documents, interviews with people affected by the disaster, local activists, representatives of public institutions, scientists, and participative observation of events related to the legacy of the disaster.

4. Stavros Dimas, Member of the European Commission, Responsible for Environment, "Seveso: The Lessons from the Last 30 Years," European Parliament, Brussels, 11 October 2006, SPEECH/06/588.

5. A question that remains open is the doubt concerning the true destination of the TCP produced by ICMESA in the early 1970s. According to journalist Daniele Biacchessi (1997), it was transported to the United States and used in the production of chemical weapons for the Vietnam War.

6. The air emission originated from a TBC (1,2,3,4-tetrachlorobenzene) alkaline hydrolysis reaction vessel of sodium 2,4,5-trichlorophenate, an intermediate compound in the preparation of trichlorophenol. The direct cause of the emission was excessive pressure induced by an exothermic reaction in the TCP vessel, which occurred a few hours after suspending operations and caused the disk of a safety valve to break down: the disk broke when the pressure reached 4 atmospheres at 250°C, and TCDD—together with the above-mentioned products, and with ethylenic glycol and soda—burst out of the roof and spread directly in the air due to the lack of

an expansion chamber (Ramondetta and Repossi 1998).

7. The mixture inside the vessel at the moment operations were suspended was probably composed of about 2,030 kg of sodium 2,4,5-trichlorophenate (or other TCB hydrolysis products), 540 kg of sodium chloride, and over 2,000 kg of organic products. In recovering the vessel, 2,171 kg of material, mainly sodium chloride (1,560 kg) were found. It can therefore be concluded that the air emission, composed of a mixture of several different pollutants including dioxin, was about 3,000 kg. As for the dioxin content in the toxic cloud, technical literature reports different evaluations, ranging from 300 g to 130 kg (Ramondetta and Repossi 1998).

8. In zone A (108 hectares, 736 inhabitants), the authorities decided on the evacuation of the whole population; in Zone B (269 hectares, 4,600 inhabitants) there was no evacuation, but the inhabitants were forced to follow strict rules of conduct; in the Prevention Zone (1,430 hectares, 31,800 inhabitants) there was no evacuation but inhabitants were forced to follow some precautionary rules of conduct, less constraining than those in zone B.

9. Voluntary pregnancy terminations were finally permitted in Italy by law 194 in 1978.

10. Medicina Democratica (Democratic Medicine) was an Italian social movement born in the 1970s on the initiative of industrial workers, scientists, and intellectuals. MD argued for the importance of developing participative forms of knowledge production on health problems related to industrial activities.

11. Comunione e Liberazione is a Catholic movement born in Italy in the 1950s and particularly active in Lombardy. Its main trait is the charismatic dimension that goes with the promotion of what are called *opere,* that is, the supply of social services through associative organizations. The relationship between CL and the state has always involved a measure of conflict. In the opinion of CL, the state cannot and ought not take part in social organization: “The welfare State must

limit its intrusion into people lives" (Abruzzese 1991: 171). On the "fundamentalism" of CL, see Zadra (1994).

12. The compensation issue remained open in Seveso until 2007, when the two proceedings instituted against Roche on the initiative of two groups of dioxin victims were declared invalid as a result of the statute of limitations. The two groups of victims never succeeded in gaining local support for their initiative (Centemeri 2006: 135–58). It is important to note that Roche has never admitted its responsibility for the disaster in any court of law.

13. Interview with L.S., resident of Seveso (April 2004).

14. Interview with Massimo Donati (June 2004).

15. Ibid.

16. As Barbara Allen remarks in her study on the mobilization of citizens for environmental health in the Louisiana "chemical corridor": "by placing the specific resident or community at the centre of an investigation, science is constructed around what is happening to the people, rather than people being constructed to fit mathematical scientific models" (Allen 2003: 148).

17. For a critique of this approach in the field of job-related cancers, see Thébaud-Mony (2007).

18. On this point see also the chapters of Barbara Allen and of Paul Jobin and Yu-Hwei Tseng in this volume.

19. Another case of this virtuous alchemy is discussed by Paul Jobin (2006) in his study of the Minamata disease.